

CLAIMS:

1. An optical scanning device for scanning an optical record carrier comprising an information layer, the device comprising a radiation source for generating a main radiation beam and a subsidiary radiation beam, and a lens system, located between the radiation source and the information layer, for converging the main beam and the subsidiary beam to
5 respective spots on the information layer, the main beam spot having a side-lobe, wherein the device includes:
a phase modulating arrangement for generating a non-rotationally-symmetric phase profile in a subsidiary radiation beam, the subsidiary radiation beam being of a predetermined wavelength, the phase profile varying with an azimuthal angle measured about
10 the optical axis of the beam portion, the phase profile varying such that successively different phases are introduced in at least five locations which are each at successive azimuthal angles ($\phi_1, \phi_2, \dots \phi_N$) and each at a given radial distance from the optical axis, wherein the phase profile is such that the phases introduced, when taken in modulo 2π form, successively cycle through 0 to 2π at least twice, in each cycle taking at least a relatively low
15 value and a relatively high value, whereby the subsidiary beam spot is provided with an intensity distribution on the information layer which overlaps that of the main beam spot side-lobe.
2. An optical scanning device according to claim 1, wherein the phase profile is
20 such that the phases introduced cycle through 0 to 2π three times.
3. An optical scanning device according to claim 1 or 2, wherein the first azimuthal angle ϕ_1 and the last azimuthal angle ϕ_N differ by approximately 2π radians.
- 25 4. An optical scanning device according to claim 1, 2 or 3, wherein the phases introduced vary monotonically between the first said azimuthal angle ϕ_1 and a third said azimuthal angle ϕ_3 .

5. An optical scanning device according to any preceding claim, wherein the main radiation beam has a first polarisation and the subsidiary radiation beam has a second polarisation, which is substantially orthogonal in relation to the first polarisation.

5 6. An optical scanning device according to claim 5, wherein the phase modulating arrangement comprises a birefringent element having substantially no effect on the phase profile of the main radiation beam, and providing the said phase profile in the subsidiary radiation beam.

10 7. An optical scanning device according to any preceding claim, wherein the main beam and the subsidiary beam are generated using a single radiation emitter.

8. An optical scanning device according to any preceding claim, wherein the phase modulating arrangement comprises a plurality of angularly-spaced segments, each of
15 the segments having a substantially constant phase profile taken at a constant radius, and wherein each of the said locations are located in a different said segment.

9. An optical scanning device according to any of claims 1 to 5, wherein the phase modulating arrangement comprises a surface providing a continuously varying phase
20 profile.

10. An optical scanning device according to any preceding claim, wherein the device further comprises a signal processing arrangement for performing crosstalk cancellation using a signal detected in the subsidiary beam.
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11. An optical scanning device according to any preceding claim, wherein the intensity distribution of the subsidiary beam on the information layer is more closely matched with the main beam spot side-lobe by selectively blocking a part of the subsidiary beam.

30 12. An optical scanning device according to any preceding claim, wherein the intensity distribution of the main beam spot side-lobe on the information layer is more closely matched with the subsidiary beam by selectively blocking a part of the main beam spot.

13. An optical phase modulating element for generating a non-rotationally-symmetric phase profile in a radiation beam of a predetermined wavelength, the phase profile varying with an azimuthal angle measured about a centre of the element, the phase profile varying such that successively different phases are introduced in at least five locations which
5 are each at successive azimuthal angles ($\varphi_1, \varphi_2, \dots \varphi_N$) and each at a given radial distance from the centre,
wherein the phase profile is such that the phases introduced, when taken in modulo 2π form, successively cycle through 0 to 2π at least twice, in each cycle taking at least a relatively low value and a relatively high value.